A. INTRODUCTION

This chapter evaluates the greenhouse gas (GHG) emissions that would be generated by the construction and operation of the proposed project and its consistency with the citywide GHG reduction goals.

As discussed in New York State Department of Environmental Conservation (NYSDEC) policy[1] and the 2014 *City Environmental Quality Review* (*CEQR) Technical Manual*, climate change is projected to have wide-ranging effects on the environment, including rising sea levels, increases in temperature, and changes in precipitation levels. Although this is occurring on a global scale, the environmental effects of climate change are also likely to be felt at the local level. New York City and State have established sustainability initiatives and goals aimed at greatly reducing GHG emissions and adapting to climate change in the City and State.

Per the *CEQR Technical Manual*, the citywide GHG reduction goal is currently the most appropriate standard by which to analyze a project under CEQR. The *CEQR Technical Manual* recommends that a GHG consistency assessment be conducted for any project conducting an environmental impact statement expected to result in 350,000 square feet or more of development and other energy-intense projects. While the proposed Gilder Center project at the American Museum of Natural History (AMNH) would only add approximately 203,000 gross square feet (gsf) of developed floor area and would not include any energy-intense components, nonetheless, a GHG consistency assessment is conservatively provided. The approach outlined is also consistent with the above referenced NYSDEC policy.

As an institution dedicated to the understanding and preservation of the natural world, the Museum has a deep commitment to reducing its energy usage and carbon footprint. Since 2003, with competitive funding from New York City (by way of PlaNYC) and other sources, the Museum reduced energy consumption by 26 percent. As planning for the Gilder Center continues, the design team is collaborating with Atelier Ten, an international environmental consulting firm on an enhanced integrated approach to energy savings and sustainability. Strategies include a high performance building envelope and ample natural daylight within, coupled with fritted glass for shading. The collaborative effort will continue as the design is advanced, with a commitment to seeking LEED Gold certification.

PRINCIPAL CONCLUSIONS

The *CEQR Technical Manual* defines five goals through which a project's consistency with the City's emission reduction goal is evaluated: (1) efficient buildings; (2) clean power; (3) sustainable transportation; (4) construction operation emissions; and (5) building materials carbon intensity.

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[1] NYSDEC. *DEC Policy: Assessing Energy Use and Greenhouse Gas Emissions in Environmental Impact Statements*. July 15, 2009.

The Museum is currently evaluating the specific energy efficiency measures and design elements that may be implemented, and is seeking to achieve Gold-level certification under the Leadership in Energy and Environmental Design (LEED) rating system, version 4. The applicant is committed at a minimum to achieve the energy efficiency requirements under LEED and would likely exceed them. To qualify for LEED, the project would be required to exceed the energy requirements of ASHRAE 90.1-2010, resulting in energy expenditure lower than a baseline building designed to meet but not exceed that standard by 5 percent. Given the LEED Gold target, the project is seeking at least 26 percent reduction in energy expenditure relative to ASHRAE 90.1-2010. New York City has recently adopted enhancements to the building energy code, applying the ASHRAE 90.1-2013 standard. It is estimated that meeting the minimum requirements for LEED would result in energy expenditure that is 2 to 4 percent lower than the minimum New York City building code requirements, and the LEED Gold target will result in much higher reductions. The current design includes measures which achieve much higher reduction in GHG emissions relative to code. The project's commitment to building energy efficiency, substantially exceeding the building code energy requirements, ensures consistency with the efficient buildings goal defined in the *CEQR Technical Manual* as part of the City's GHG reduction goal (see Section F). The project would also reduce emissions indirectly by using sustainable and recycled materials, and reducing water consumption and runoff.

The proposed project would also support the other GHG goals identified in the *CEQR Technical Manual* by virtue of its nature and location: its proximity to public transportation, reliance on Con Edison steam and combined cooling water system with the existing Museum, and the fact that as a matter of course, construction in New York City uses recycled steel and includes cement replacements. All of these factors demonstrate that the proposed development supports the GHG reduction goal.

Therefore, based on the commitment to energy efficiency and sustainable design, and by virtue of its location, the proposed project would be consistent with the City's emissions reduction goals, as defined in the *CEQR Technical Manual*.

B. POLLUTANTS OF CONCERN

GHGs are those gaseous constituents of the atmosphere, both natural and anthropogenic (human-caused), that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds. This phenomenon causes the general warming of the Earth's atmosphere, or the "greenhouse effect." Water vapor, carbon dioxide (CO_2), nitrous oxide (N_2O), methane, and ozone are the primary greenhouse gases in the Earth's atmosphere.

There are also a number of entirely anthropogenic greenhouse gases in the atmosphere, such as halocarbons and other chlorine- and bromine-containing substances, which also damage the stratospheric ozone layer (and contribute to the "ozone hole"). Since these compounds are being replaced and phased out due to the 1987 Montreal Protocol, there is no need to address them in GHG assessments for most projects. Although ozone itself is also a major greenhouse gas, it does not need to be assessed as such at the project level since it is a rapidly reacting chemical and efforts are ongoing to reduce ozone concentrations as a criteria pollutant (see Chapter 10, "Air Quality"). Similarly, water vapor is of great importance to global climate change, but is not directly of concern as an emitted pollutant since the negligible quantities emitted from anthropogenic sources are inconsequential.

CO_2 is the primary pollutant of concern from anthropogenic sources. Although not the GHG with the strongest effect per molecule, CO_2 is by far the most abundant and, therefore, the most influential GHG. CO_2 is emitted from any combustion process (both natural and anthropogenic); from some industrial processes such as the manufacture of cement, mineral production, metal production, and the use of petroleum-based products; from volcanic eruptions; and from the decay of organic matter. CO_2 is removed ("sequestered") from the lower atmosphere by natural processes such as photosynthesis and uptake by the oceans. CO_2 is included in any analysis of GHG emissions.

Methane and N_2O also play an important role since the removal processes for these compounds are limited and because they have a relatively high impact on global climate change as compared with an equal quantity of CO_2. Emissions of these compounds, therefore, are included in GHG emissions analyses when the potential for substantial emission of these gases exists.

The *CEQR Technical Manual* lists six GHGs that could potentially be included in the scope of a GHG analysis: CO_2, N_2O, methane, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). This analysis focuses mostly on CO_2, N_2O, and methane. There are no significant direct or indirect sources of HFCs, PFCs, or SF_6 associated with the proposed development.

To present a complete inventory of all GHGs, component emissions are added together and presented as carbon dioxide equivalent (CO_2e) emissions—a unit representing the quantity of each GHG weighted by its effectiveness using CO_2 as a reference. This is achieved by multiplying the quantity of each GHG emitted by a factor called global warming potential (GWP). GWPs account for the lifetime and the radiative forcing of each chemical over a period of 100 years (e.g., CO_2 has a much shorter atmospheric lifetime than SF_6, and therefore has a much lower GWP). The GWPs for the main GHGs discussed are presented in **Table 11-1**.

Table 11-1
Global Warming Potential (GWP) for Major GHGs

Greenhouse Gas	100-year Horizon GWP
Carbon Dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous Oxide (N_2O)	310
Hydrofluorocarbons (HFCs)	140 to 11,700
Perfluorocarbons (PFCs)	6,500 to 9,200
Sulfur Hexafluoride (SF_6)	23,900

Source: 2014 *CEQR Technical Manual.*
Note: The GWPs from the *CEQR Technical Manual* are based on the Intergovernmental Panel on Climate Change's (IPCC) Second Assessment Report (SAR) to maintain consistency in GHG reporting. The IPCC has since published updated GWP values that reflect new information on atmospheric lifetimes of GHGs and an improved calculation of the radiative forcing of CO_2. In some instances, if combined emission factors were used from updated modeling tools (where GWP is part of the combined factor), those may include slightly different GWP values and would result in slightly different emissions. However, because the emissions of GHGs other than CO_2 represent a very minor component of the emissions, these differences are negligible.

C. POLICY, REGULATIONS, STANDARDS, AND BENCHMARKS FOR REDUCING GHG EMISSIONS

As a result of the growing consensus that human activity resulting in GHG emissions is already affecting and has the potential to profoundly impact the Earth's climate, countries around the world have undertaken efforts to reduce emissions by implementing both global and local measures addressing energy consumption and production, land use, and other sectors. Although the U.S. has not ratified international agreements which set emissions targets for GHGs, in December 2015, the U.S. signed the international Paris agreement[2] that pledges deep cuts in emissions, with a stated goal of reducing emissions to between 26 and 28 percent lower than 2005 levels by 2025[3] to be implemented by existing laws and regulations with executive authority of the President.

The U.S. Environmental Protection Agency (USEPA) is required to regulate greenhouse gases under the Clean Air Act (CAA), and has begun preparing and implementing regulations. In coordination with the National Highway Traffic Safety Administration (NHTSA), USEPA currently regulates GHG emissions from newly manufactured on-road vehicles. In addition, USEPA regulates transportation fuels via the Renewable Fuel Standard program, which will phase in a requirement for the inclusion of renewable fuels increasing annually up to 36.0 billion gallons in 2022. In 2015, USEPA also finalized rules to address GHG emissions from both new and existing power plants that would, for the first time, set national limits on the amount of carbon pollution that power plants can emit. The Clean Power Plan sets carbon pollution emission guidelines and performance standards for existing, new, and modified and reconstructed electric utility generating units. On February 9, 2016, the Supreme Court stayed implementation of the Clean Power Plan pending judicial review. USEPA expects to expand this program in the future to limit emissions from additional stationary sources

There are also regional and local efforts to reduce GHG emissions. In 2009, Governor Paterson issued Executive Order No. 24, establishing a goal of reducing GHG emissions in New York State by 80 percent, compared with 1990 levels, by 2050, and creating a Climate Action Council tasked with preparing a climate action plan outlining the policies required to attain the GHG reduction goal; an interim draft plan has been published.[4] The State is now seeking to achieve some of the emission reduction goals via local and regional planning and projects through its Cleaner Greener Communities and Climate Smart Communities programs. The State has also adopted California's GHG vehicle standards (which are at least as strict as the federal standards).

The New York State Energy Plan outlines the State's energy goals and provides strategies and recommendations for meeting those goals. The latest version of the plan was published in June 2015. The new plan outlines a vision for transforming the state's energy sector which would result in increased energy efficiency (both demand and supply), increased carbon-free power production and cleaner transportation, in addition to achieving other goals not related to GHG emissions such as economic development. The 2015 plan also establishes a new target of

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[2] Conference of the Parties, 21st Session. *Adoption of The Paris Agreement, decision -/CP.21*. Paris, December 12, 2015.

[3] United States of America. *Intended Nationally Determined Contributions (INDCs)* as submitted. March 31, 2015.

[4] New York State Climate Action Council. *New York State Climate Action Plan Interim Report*. November 2010.

reducing GHG emissions in New York State by 40 percent, compared with 1990 levels, by 2030. The plan also establishes a new target of providing 50 percent of electricity generation in the state from renewable sources by 2030, and increasing building energy efficiency gains by 600 trillion British thermal units (Btu) by 2030.

New York State has also developed regulations to cap and reduce CO_2 emissions from power plants to meet its commitment to the Regional Greenhouse Gas Initiative (RGGI). Under the RGGI agreement, the governors of nine northeastern and Mid-Atlantic states have committed to regulate the amount of CO_2 that power plants are allowed to emit, gradually reducing annual emissions to half the 2009 levels by 2020. The RGGI states and Pennsylvania have also announced plans to reduce GHG emissions from transportation, through the use of biofuel, alternative fuel, and efficient vehicles.

Many local governments worldwide, including New York City, are participating in the Cities for Climate Protection™ (CCP) campaign and have committed to adopting policies and implementing quantifiable measures to reduce local GHG emissions, improve air quality, and enhance urban livability and sustainability. New York City's long-term comprehensive plan for a sustainable and resilient New York City, which began as PlaNYC 2030 in 2007, and continues to evolve today as OneNYC, includes GHG emissions reduction goals, many specific initiatives that can result in emission reductions, and initiatives aimed at adapting to future climate change impacts. The goal to reduce citywide GHG emissions to 30 percent below 2005 levels by 2030 ("30 by 30") was codified by Local Law 22 of 2008, known as the New York City Climate Protection Act (the "GHG reduction goal")[5] The City has also announced a longer-term goal of reducing emissions to 80 percent below 2005 levels by 2050 ("80 by 50"), which was codified by Local Law 66 of 2014, and has published a study evaluating the potential for achieving that goal. More recently, as part of OneNYC, the City has announced a more aggressive goal for reducing emissions from building energy down to 30 percent below 2005 levels by 2025.

In December 2009, the New York City Council enacted four laws addressing energy efficiency in large new and existing buildings, in accordance with PlaNYC. The laws require owners of existing buildings larger than 50,000 square feet to conduct energy efficiency audits and retro-commissioning every 10 years, to optimize building energy efficiency, and to "benchmark" the building energy and water consumption annually, using an USEPA online tool. By 2025, commercial buildings over 50,000 square feet will also require lighting upgrades, including the installation of sensors and controls, more efficient light fixtures, and the installation of submeters, so that tenants can be provided with information on their electricity consumption. The legislation also creates a local New York City Energy Conservation Code, which along with the Energy Conservation Construction Code of New York State (as updated in 2016), requires equipment installed during a renovation to meet current efficiency standards.

To achieve the 80 by 50 goal, the City is convening Technical Working Groups to analyze the GHG reduction pathways from the building sector, power, transportation, and solid waste sectors to develop action plans for these sectors. The members of the Technical Working Groups will develop and recommend the data analysis, interim metrics and indicators, voluntary actions, and potential mandates to effectively achieve the City's emissions reduction goal. In 2016, the City published the building sector Technical Working Group report, which included commitments by the City to change the building energy code and take other measures aimed at substantially reducing GHG emissions.

5 Administrative Code of the City of New York, §24-803.

For certain projects subject to CEQR (e.g., projects with 350,000 gsf or more of development or other energy intense projects), an analysis of the projects' contributions to GHG emissions is required to determine consistency with the City's reduction goal, which is currently the most appropriate standard by which to analyze a project under CEQR, and is therefore applied in this chapter. While the proposed project would only add approximately 203,000 gsf of developed floor area and would not include any energy-intense components, nonetheless, a GHG consistency assessment is conservatively provided.

A number of benchmarks for energy efficiency and green building design have also been developed. For example, the LEED system is a benchmark for the design, construction, and operation of high-performance green buildings that includes energy efficiency components. USEPA's Energy Star is a voluntary labeling program designed to identify and promote the construction of new energy efficient buildings, facilities, and homes and the purchase of energy efficient appliances, heating and cooling systems, office equipment, lighting, home electronics, and building envelopes. The Museum is currently evaluating the specific energy efficiency measures and design elements which would be implemented, and has targeted a LEED (version 4) Gold rating.

D. METHODOLOGY

Climate change is driven by the collective contributions of diverse individual sources of emissions to global atmospheric GHG concentrations. Identifying potential GHG emissions from a proposed action can help decision makers identify practicable opportunities to reduce GHG emissions and ensure consistency with policies aimed at reducing overall emissions. While the increments of criteria pollutants and toxic air emissions are assessed in the context of health-based standards and local impacts, there are no established thresholds for assessing the significance of a project's contribution to climate change. Nonetheless, prudent planning dictates that all sectors address GHG emissions by identifying GHG sources and practicable means to reduce them. Therefore, this chapter presents the total GHG emissions potentially associated with the proposed project and identifies measures that would be implemented and measures that are still under consideration to limit emissions.

The analysis of GHG emissions that would be associated with the proposed project is based on the methodology presented in the *CEQR Technical Manual*. Estimates of emissions of GHGs from the Gilder Center have been quantified, including off-site emissions associated with use of electricity and steam and emissions from vehicle use associated with the proposed project (the project has no on-site fuel consumption other than negligible cooking gas use). GHG emissions that would result from construction are discussed as well.

CO_2 is the primary pollutant of concern from anthropogenic emission sources and is accounted for in the analysis of emissions from all development projects. GHG emissions for gases other than CO_2 are included where practicable or in cases where they comprise a substantial portion of overall emissions. The various GHG emissions are added together and presented as metric tons of carbon dioxide equivalent (CO_2e) emissions per year (see "Pollutants of Concern," above).

BUILDING OPERATIONAL EMISSIONS

Estimates of emissions due to electricity and steam use were prepared using projections of energy consumption developed by the proposed project engineers and the emission factors provided in the *CEQR Technical Manual*.[6] The emission factor for steam use provided in the *CEQR Technical Manual* (Table 18-4) and the emission factor for electricity from the latest New York City GHG inventory[7] were applied to calculate the emissions associated with electricity and steam use. Note that these emission factors are conservatively high, since the carbon intensity of New York City's electricity supply will likely be lower in the 2021 build year and continue to decrease in future years as the fraction of electricity generated from renewable sources continues to increase. Since the methodology does not account for future year changes to the electric grid power production, it also does not explicitly address potential changes in future consumption associated with climate change, such as increased electricity for cooling, or decreased steam for heating. Overall, this analysis results in conservatively high potential GHG emissions.

The electricity and steam usage and emission factors are presented below along with the results for the building operational emissions.

MOBILE SOURCE EMISSIONS

The number of annual weekday and Saturday vehicle trips by mode (cars, taxis, and trucks) that would be generated by the proposed project was calculated using the transportation planning assumptions developed for the analysis and presented in Chapter 9, "Transportation." The assumptions used in the calculation include average daily weekday and Saturday person trips and delivery trips, the percentage of vehicle trips by mode, and the average vehicle occupancy. To calculate annual totals, the number of trips on Sundays was assumed to be the same as on Saturday. Travel distances shown in Table 18-6 and 18-7 and associated text of the *CEQR Technical Manual* were used in the calculations of annual vehicle miles traveled by cars, taxis, and trucks. Table 18-8 of the *CEQR Technical Manual* was used to determine the percentage of vehicle miles traveled by road type and the mobile GHG emissions calculator provided with the manual was used to obtain an estimate GHG emissions from car, taxi, and truck trips attributable to the proposed project. Note that the CEQR emission factors are for the 2021 build year, and would be lower in subsequent years as vehicle engine efficiency increases and emissions standards continue to decrease, resulting in lower emissions in future years.

USEPA estimates that the well-to-pump GHG emissions of gasoline and diesel are more than 20 percent of the tailpipe emissions.[8] Although upstream emissions (emissions associated with production, processing, and transportation) of all fuels can be substantial and are important to consider when comparing the emissions associated with the consumption of different fuels, vehicle fuel alternatives are not being considered for the proposed development, and as per the *CEQR Technical Manual* guidance, the well-to-pump emissions are not considered in the analysis. The assessment of tailpipe emissions only is in accordance with the *CEQR Technical*

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6 The Environmental Assessment Statement (EAS) contains an estimate of the proposed project's energy consumption, based on a rate of 250.7 thousand Btu (MBtu)/square foot, which the *CEQR Technical Manual* identifies as the average whole-building energy use for institutional uses in New York City. Due to a typographical error, the CEQR calculation was stated as 4.3 trillion BTUs in one location in the EAS, whereas the correct calculation is 4.3 million BTUs. This chapter includes an assessment of the proposed project's GHG emissions, based on more refined project-specific information rather than standard CEQR multipliers.

7 The City of New York Mayor's Office of Long-Term Planning and Sustainability. *Inventory of New York City Greenhouse Gas Emissions in 2015*. September 2016.

8 USEPA. *MOVES2004 Energy and Emission Inputs*. Draft Report, EPA420-P-05-003. March 2005.

Manual guidance on assessing GHG emissions and the methodology used in developing the New York City GHG inventory, which is the basis of the GHG reduction goal.

The projected annual vehicle miles traveled, forming the basis for the GHG emissions calculations from mobile sources, are summarized in **Table 11-2**.

Table 11-2
Estimated Vehicle Miles Traveled per Year

Roadway Type	Passenger Vehicle	Taxi	Tour Bus	Truck
Local	24,538	12,577	3,760	74,153
Arterial	53,537	27,442	8,204	161,789
Interstate/Expressway	33,461	17,151	5,127	101,118
Total	**111,536**	**57,170**	**17,091**	**337,060**

CONSTRUCTION EMISSIONS

A description of construction activities is provided in Chapter 15, "Construction Impacts." Consistent with CEQR practice, emissions associated with construction have not been estimated explicitly for the proposed project, but analyses of similar projects in New York City which did include detailed construction analyses have shown that construction emissions (both direct and emissions embedded in the production of materials, including on-site construction equipment, delivery trucks, and upstream emissions from the production of steel, rebar, aluminum, and cement used for construction) are generally equivalent to the total operational emissions for a building over approximately 5 to 10 years.

EMISSIONS FROM SOLID WASTE MANAGEMENT

The proposed project would not fundamentally change the City's solid waste management system. Therefore, as per the *CEQR Technical Manual*, the GHG emissions from solid waste generation, transportation, treatment, and disposal are not quantified.

TREE REMOVAL

It is currently expected that the proposed project would directly affect seven canopy trees in Theodore Roosevelt Park that would be removed and one understory tree that would be relocated. Construction would be performed in compliance with an approved tree protection plan and NYC Parks tree protection protocols. Any trees that are removed and not transplanted would be replaced, consistent with New York City Department of Parks and Recreation (NYC Parks) rules and regulations, which would include six new canopy trees and thirteen new understory trees that would be planted post-construction as part of the landscape plan for the western portion of the Park. The effect of the proposed project on GHG emissions associated with trees has not been quantified. Overall, the proposed project would not substantially affect long term carbon storage or sequestration provided by trees, and may increase sequestration and storage in the long term by introducing an increased number of trees overall.

E. PROJECTED GHG EMISSIONS

BUILDING OPERATIONAL EMISSIONS

The steam and electricity use, emission factors, and resulting GHG emissions from each of the energy streams are presented in detail in **Table 11-3**. Based on the latest GHG inventory for New York City, it is estimated that the building energy emissions would actually be at least 12 percent lower than those calculated here since the carbon intensity of the grid power has declined by that amount since the CEQR factors were calculated for the city. Note that these estimates include energy efficiency design and operational measures currently included in the proposed design, resulting in annual emissions that would be substantially lower than the same building designed to meet but not exceed the building energy code. Additional measures are being reviewed, with the intention of further reducing energy expenditure. See additional information in Section F, "Elements That Would Reduce GHG Emissions."

Table 11-3
Annual Building Operational Emissions

Source	Annual Consumption (MMBtu/yr)	Emission Factor (kg CO_2e/yr)	GHG Emissions (metric tons CO_2e/yr)
Con Edison Steam	5,005	64.306 (1)	321.9
Grid Electricity *	11,522	75.32 (2)	867.9
		Total:	**1,189.7**

Notes: Per *CEQR Technical Manual* guidance, electricity emissions represent recent data (likely 2009) and not the target year (2021). Future emissions are expected to be lower.
* Includes electricity used to produce chilled water.
Sources: 1. *CEQR Technical Manual*, Table 18-4
2. *Inventory of New York City Greenhouse Gas Emissions in 2015.* September 2016

MOBILE SOURCE EMISSIONS

The mobile-source-related GHG emissions from the proposed project are presented in detail in **Table 11-4**.

Table 11-4
Annual Mobile Source Emissions, 2021

Vehicle Type	Emissions (metric tons CO_2e)
Passenger Vehicle	67.3
Taxi	30.9
Tour Bus	39.5
Truck	727.8
Total	**865.5**

SUMMARY

Total GHG emissions associated with the proposed project after it is built and operational are estimated at 2,055 metric tons CO_2e per year, with roughly 40 percent of that amount from on-road sources, and 60 percent from building energy. This includes a substantial reduction in building energy emissions associated with measures incorporated in the current design that exceed minimum building energy code requirements. As described in the "Methodology" section above, construction emissions were not modeled explicitly, but are estimated to be equivalent to approximately 5 to 10 years of operational emissions, including both direct energy and emissions embedded in materials (extraction, production, and transport). The proposed project is not expected to fundamentally change the City's solid waste management system, and therefore emissions associated with solid waste are not presented. Carbon sequestration would not be reduced as a consequence of tree removal and replanting.

The applicant is currently evaluating the specific energy efficiency measures and design elements that would be implemented, and intends to achieve substantial energy efficiency and implement additional measures which would reduce GHG emissions (see Section F, below).

F. ELEMENTS THAT WOULD REDUCE GHG EMISSIONS

The proposed project would include a number of sustainable design features which would, among other benefits, result in lower GHG emissions. The Museum is currently evaluating the specific energy efficiency measures and design elements that may be implemented, and is seeking to achieve Gold-level certification under the Leadership in Energy and Environmental Design (LEED) rating system, version 4. The Museum is committed at a minimum to achieve the energy efficiency requirements under LEED and would likely exceed them with the target of substantially reducing building energy expenditure in order to achieve its target of Gold certification.

In general, energy efficient development with access to transit and existing roadways is consistent with sustainable land use planning and smart growth strategies to reduce the carbon footprint of development. These features and other measures currently under consideration are discussed in this section, addressing the PlaNYC/OneNYC goals as outlined in the *CEQR Technical Manual*. The implementation of the various design measures and features described would result in development that is consistent with the City's emissions reduction goal, as defined in the *CEQR Technical Manual*.

BUILD EFFICIENT BUILDINGS

The Gilder Center would incorporate insulation exceeding building code requirements; window glazing which would optimize daylighting, heat loss and solar heat gain; and include green roof sections and use high-albedo roofing materials. These measures would result in a highly efficient building envelope resulting in substantial savings by reducing energy loss to the surrounding atmosphere.

The Gilder Center's highly efficient HVAC systems would share the existing museum's cooling water system and employ steam provided by Con Edison. The Central Hall—a large central atrium—would have supply air at floor level, focusing on conditioning occupied space and reducing energy consumption for air volumes in areas above the occupied space. The facility would incorporate motion sensor lighting control, use efficient, directed exterior lighting (excluding park lighting which would follow NYC Parks guidelines) and use efficient lighting and elevators, and Energy Star appliances. These systems ensure reduced fuel and electricity consumption and low plug-load. Submetering of electricity, water, steam, and cooling water would provide useful data for the facility team to regularly monitor operation of the facility and optimize and fine tune usage, as necessary, and 3rd-party commissioning would be undertaken to ensure that the facility is providing the energy performance that the project team intended. The design also minimizes the building footprint, making efficient use of the space and reducing building energy demand. All of these measures would result in lower energy usage and associated GHG emissions.

In addition to direct energy savings, the Gilder Center would use water conserving fixtures that exceed building code requirements, collect and re-use rainwater from the Gilder Center roof, include green infrastructure to lower stormwater collection needs, incorporate water efficient landscaping, and use efficient irrigation systems. The proposed project would also provide for storage and collection of recyclables (including paper, corrugated cardboard, glass, plastic, and metals) in the building design. All of these measures would reduce GHG emissions from upstream sources associated with producing and delivering materials, wastewater treatment, and providing potable water (see additional renewable materials in the final section below).

As the museum does now, The Gilder Center may participate in Demand Response programs under which it would reduce electric consumption at peak demand times to help Con Edison reduce the use of less efficient peak power production facilities.

There are also several design aspects of the proposed project that would contribute to increased energy efficiency and reduced GHG emissions. The Gilder Center would be efficient by virtue of being infill development that requires less new infrastructure and connections, and benefiting from the efficiency of combined energy systems with the existing Museum. The design includes approximately 42,000 square feet of renovated space, prioritizing reuse of existing assets such as floors, ceilings, and walls, and reducing the need for new construction. The extensive interconnection with the Museum campus resulting from the proposed project would allow the institution overall to function more effectively, reducing the need for new space. The Gilder Center would be largely surrounded by existing buildings, reducing the exterior envelope and increasing energy efficiency and increasing self-shading.

USE CLEAN POWER

The proposed project would use steam provided centrally, which is produced as part of a cogeneration system providing electric power, reducing the GHG emissions associated with providing the heat and electricity by producing steam as a byproduct. The Museum is also considering the possibility of incorporating photovoltaic systems, which would provide locally generated renewable energy.

TRANSIT-ORIENTED DEVELOPMENT AND SUSTAINABLE TRANSPORTATION

The proposed project is located in an area heavily supported by many transit options (existing bus and subway services immediately adjacent to the project). In addition, the proposed project is adjacent to major bike routes on Columbus Avenue and on West 77th and 78th streets and next to several Citi Bike stations. The proposed project would also likely allocate some of its existing parking for alternative vehicles and provide on-site charging stations for electric vehicles. The proposed project is not seeking any additional parking, and thus encourages the use of transit, cycling, and walking. Employees are provided with information related to 511NY Rideshare program as part of the employee guide, and have the opportunity to use the Transit check system to pay for transit expenses with pre-tax dollars (reducing transit costs).

REDUCE CONSTRUCTION OPERATION EMISSIONS

Construction specifications would include an extensive diesel emissions reduction program, as described in detail in Chapter 15, “Construction Impacts,” including diesel particle filters for large construction engines and other measures. These measures would reduce particulate matter emissions; while particulate matter is not included in the list of standard GHGs (“Kyoto gases”), recent studies have shown that black carbon—a constituent of particulate matter—may play an important role in climate change.

USE BUILDING MATERIALS WITH LOW CARBON INTENSITY

Recycled steel would most likely be used for most structural steel since the steel available in the region is mostly recycled. Some cement replacements such as fly ash and/or slag may also be used, and concrete cement content would be optimized[9] to the extent feasible.

The design would include building materials with recycled content, use building materials that are extracted and/or manufactured within the region, and use wood that is locally produced and/or certified in accordance with the Sustainable Forestry Initiative or the Forestry Stewardship Council's Principles and Criteria.

Construction waste would be diverted from landfills to the extent practicable by separating out materials for reuse and recycling, with a diversion target of minimum 75 percent.

All of these measures would reduce GHG emissions from upstream sources associated with producing and delivering materials. ✷

9 Cement content optimization is a process of identifying the appropriate cement content for design requirements so as not to over-design concrete strength, and results in less wasteful use of cement.